


2.6 Modern Theory of Evolution



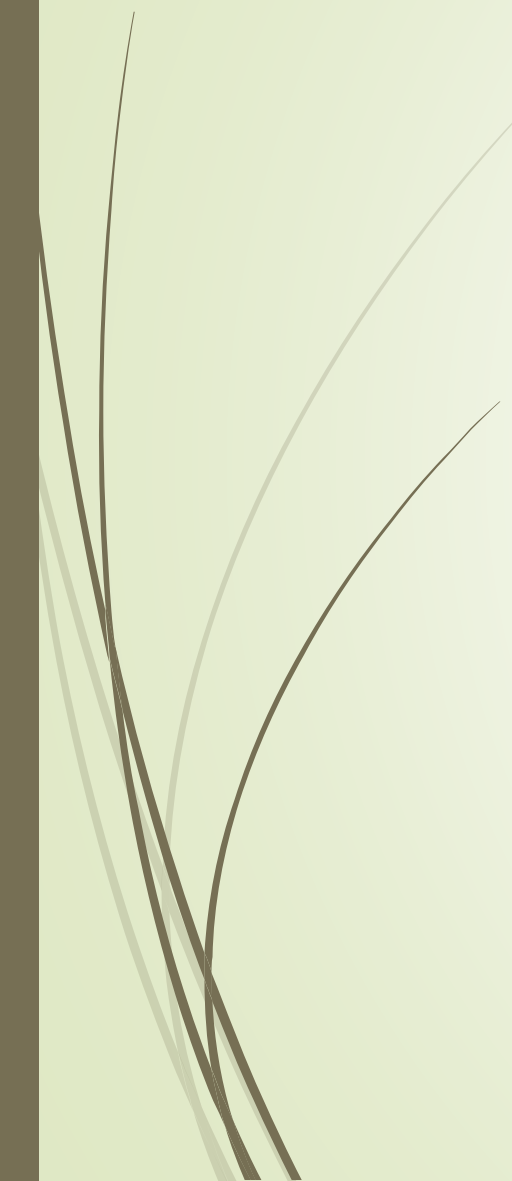


Evolutionary biology has made tremendous advances since Darwin.

- The Age of the Earth
 - Radiometric Dating (radioisotopes)
 - The Modern Synthesis
 - Mutations
 - The Effects of Mutations
 - Mutation rates
 - Homologous Gens and Pseudogenes
 - Modern Paleontology
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The Age of Earth

- Earth and our solar system is more than 4.5 billions years old.
 - The universe is approximately 13 billions years old
 - All concluded from modern geology, physics and astronomy.
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The Modern Synthesis

- Today the knowledge and understanding gained from genetics and other fields of biology have been combined with Darwin's theory to form the **modern evolutionary synthesis**.



Today

- Biologists define evolution as changes in the gene pool of a species over time.
 - Gene pool: the complete set of all alleles contained within a species or population.
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Mutations: The source of Variation

- All species exhibit genetic variation
- A genetic mutation is a change in DNA
 - DNA may be switched or lost, and/or new bases may be inserted
- DUPLICATION
 - Extra copies of genes can be a benefit (extra copy changes and not the original)
 - Example: four human gens – three involved in colour vision and one for night vision – are all thought to have been produced from a single ancestral gene.



The Effects of Mutations

- Most mutations are neutral because they occur in non-coding regions
- Therefore no visible change
- Coding DNA may make up as little as 2% of the human genome

Beneficial Mutations

- Advantage to individual and selected by environment

Harmful Mutation

- Less successful at reproducing and tend to disappear




Mutation Rates

- Mutations are relatively uncommon events
- Individual mutation rates are very difficult to estimate
- Recent studies suggest:
 - Species with large genomes are likely to have mutation rates averaging more than one per individual
 - Humans average 20 or more mutations per individual (billions of base pairs)
 - Large amount even though almost all are always neutral



Homologous Genes and Pseudogenes

- The degree of similarity between homologous genes provides good evidence for the degree of relatedness between species.
 - The more closely related two species are, the more similar we would expect their homologous genes to be.
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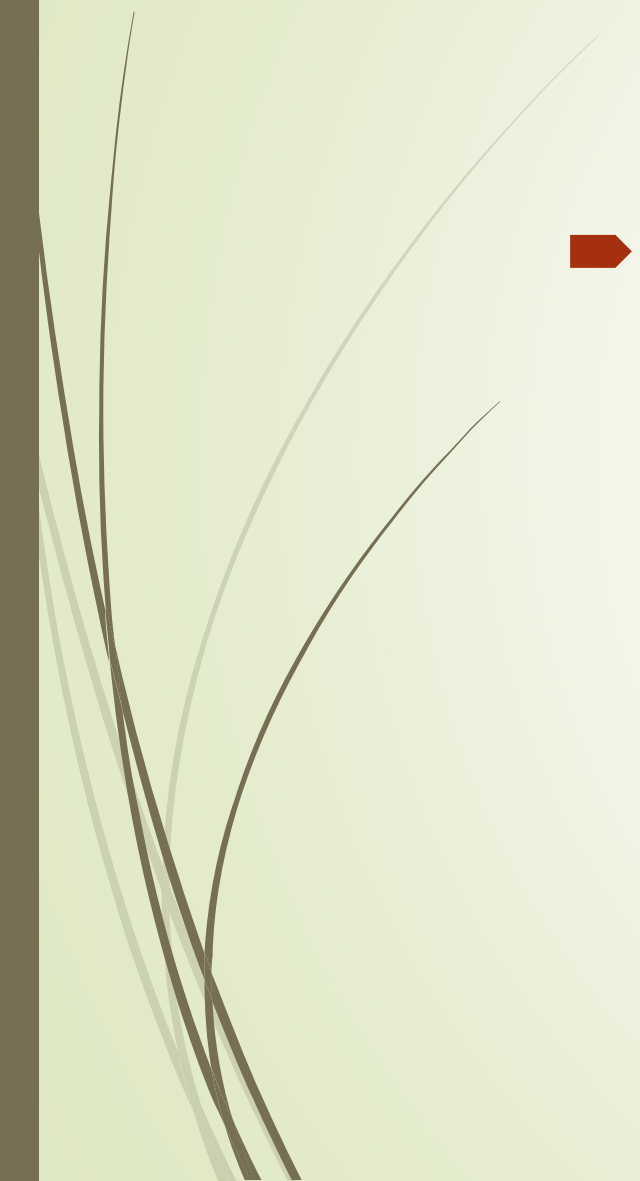
Pseudogenes

- Genes that have undergone mutations and no longer serve a useful purpose.
- Pseudogenes are like vestigial features
- Dolphins are thought to have evolved from land mammals
 - Dolphins like all mammals breath through their nose but have no need for a sense of smell in the air.
 - Mammals have approximately 1000 functioning olfactory receptor genes that code for the receptors that detect airborne chemicals.
 - Dolphins have these same 1000 genes but only 200 of them function.
- Humans have a dysfunctional copy of a GULO gene
 - Gene necessary for the production of vitamin C.
 - Normal diet now provides enough amounts of the vitamin
 - Not harmful



3. Modern Paleontology

- Last 100 years have witnessed many important fossil discoveries
 - Early human ancestors
 - Primitive whales in Pakistan
 - Feathered dinosaurs in China
 - New fossil dinosaurs in Canada
- Great advances in plate tectonics and continental drift
 - Explains discovery of the same species in Africa, India and Antarctica.
 - Pangea

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- Assigned Work
 - Read p.308-313
 - Q p. 313 # 3,6,8 and 9